

PATENT ABSTRACTS OF JAPAN

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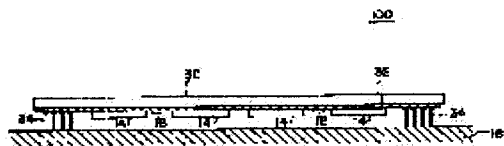
(22)Date of filing : 12.08.1993 (72)Inventor : SEYAMA KIYOTAKA
KIKUCHI SHUNICHI
SUMIYOSHI MAKOTO
YASUDA NAOKI
HIRANO MINORU
NORI HITOSHI

(54) MULTICHIP MODULE

(57)Abstract:

PURPOSE: To obtain the title module which is low-cost, whose density is high, whose speed is high and whose design and manufacture are flexible.

CONSTITUTION: The title module is constituted so as to be provided with a base board 30, with a thin-film multilayer circuit board 32 which is formed on the first face of the base board and in which insulating layers and wiring conductors are laminated alternately, with circuit elements 14, 16 which are formed on the main face of the thin-film multilayer circuit board and with terminals 34 which are supported on the main face of the thin-film multilayer circuit board and by which wiring conductors are connected to an external circuit formed on a wiring board.



[Claim(s)]

[Claim 1]A multi chip module comprising:

A base board (30).

A thin film multilayered circuit board (32) by which it was provided on the 1st [of this base board] field, and an insulating layer and a wiring conductor were laminated by turns.

A circuit element provided on the principal surface of this thin film multilayered circuit board (14, 16).

A terminal which is supported on the principal surface of said thin film multilayered circuit board, and connects said wiring conductor to an external circuit formed in a wiring board (34, 50, 52, 54).

[Claim 2]The multi chip module according to claim 1, wherein said terminal is a lead member (34, 50, 54).

[Claim 3]The multi chip module according to claim 1, wherein said terminal is a leadless member (52).

[Claim 4]A multi chip module of claims 1 thru/or 3, wherein said terminal is supported on the principal surface of said thin film multilayered circuit board with being soldered to a wiring conductor by the side of said circuit element of said wiring conductors (38) given in any 1 paragraph.

[Claim 5]A multi chip module of claim 1 thru/or 4, wherein a wiring conductor by the side of said circuit element of said wiring conductors has a pad region (32A-5) for connecting said terminal given in any 1 paragraph.

[Claim 6]The multi chip module according to claim 3, wherein said lead member is a lead pin (34) vertically prolonged from the principal surface of said thin film multilayered circuit board.

[Claim 7]The multi chip module according to claim 3, wherein said lead member is a lead pin (50) of a flat form.

[Claim 8]The multi chip module according to claim 3, wherein said lead member is a wire lead (54).

[Claim 9]The multi chip module according to claim 3, wherein said lead member is the lead (50) of tape shape.

[Claim 10]A multi chip module of claim 1 thru/or 9, wherein said terminal is provided in a periphery of said thin film multilayered circuit board so that said circuit element may be surrounded given in any 1 paragraph.

[Claim 11]A multi chip module of claim 1 thru/or 10, wherein said multi chip module has further covering (56, 58) which closes a circuit element on the principal surface of said thin film multilayered circuit board given in any 1 paragraph.

[Claim 12]Further said multi chip module on the 2nd field that counters the 1st field of said base board, A multi chip module of claim 1 thru/or 12 having the cooling structure (42, 62, 64, 66) for cooling said multi chip module given in any 1 paragraph.

[Detailed Description of the Invention]

[0001]

[Industrial Application] This invention relates to the multi chip module (MCM:MultiChip Module) which carries two or more circuit elements, such as an LSI chip, in a high-density wiring board (it is also called the circuit board) as they are.

[0002] In recent years, two or more LSI chips are carried in a high dense high density wiring board, and the multi chip module which attained improvement in the speed and low cost-ization attracts attention. As everyone knows, a multi chip module is divided roughly into three types, MCM-L, MCM-C, and MCM-D. A MCM-L type multi chip module carries a circuit element on a printed-circuit board.

Low cost-ization is enabled.

A MCM-C type multi chip module carries a circuit element on a thick film multilayered ceramic substrate, and low-cost-izing and improvement in the speed of it are to some extent attained. A MCM-D type multi chip module provides the circuit board by which the insulating layer and the wiring conductor layer were multilayered on thick film substrates, such as ceramics, and carries a circuit element on this circuit board. This MCM-D type can attain improvement in the speed and densification most compared with other two types.

[0003]

[Description of the Prior Art] Drawing 13 is a side view of a multi chip module conventional MCM-C type. The multi chip module of drawing 13 has the thick film ceramic substrate 10 of multilayered constitution. The active devices 16, such as LSI chip 14, resistance or a capacitor, are carried on the 1st [of the thick film ceramic substrate 10] field. These circuit components 14 and 16 are connected to wiring of thick film ceramic substrate 10 inside. Many I/O pins 12 are attached to the 2nd field that counters the 1st field of the above. A multi chip module mounts this I/O pin 12 directly by inserting in the printed-circuit board 18.

[0004]Drawing 14 is a side view of a multi chip module conventional MCM-D type. The same reference number is given to the same thing as the component shown in drawing 13 among drawing 14. For improvement in the speed and densification, the thin film circuit board 20 is formed on the 1st [of the thick film ceramic substrate 10] field. The circuit elements 14 and 16 are carried on this thin film circuit board 20. These circuit elements are connected to the thick film ceramic substrate 10 or the I/O pin 12 via the wiring in the thin film circuit board 20. It is the composition of providing the pad for connection (the graphic display is omitted) in the field of the thick film ceramic substrate 10 and the thin film circuit board 20 which carries out for relativity, respectively, and connecting wiring of the substrates 10 and 20. In the case of drawing 13, the multi chip module of drawing 14 is mounted in the immediate printing wiring board 18 like ** using the I/O pin 12.

[0005]Drawing 15 is a side view showing another example of composition

conventional MCM-D type. The same reference number is given to the same thing as the component shown in drawing 14 among drawing 15. The thin film circuit board 20 is carried on the base board 24 without a wiring conductor layer. The base board 24 consists of metal, such as ceramics, a silicon wafer, and aluminum. This base board 24 is built in the base board real wearing package 22. The package 22 consists of ceramics or mold resin, and has a crevice in which the base board 24 is accommodated inside. The I/O pin 28 is attached to the periphery of the package 22. The thin film circuit board 20 and the I/O pin 28 are connected with the wire 26. The pad (the graphic display is omitted) for carrying out bonding of the wire 26 is provided in the package 22. The multi chip module shown in drawing 15 is mounted on the printed-circuit board 18 via the I/O pin 28. In the composition shown in drawing 15, the circuit elements 14 and 16 face the printed-circuit board 18.

[0006]

[Problem(s) to be Solved by the Invention]However, the conventional multi chip module mentioned above has the following problem.

[0007]The thick film ceramic substrate 10 used by the multi chip module shown in drawing 13 has the low density which can form a wiring conductor compared with the thin film circuit board 20. Therefore, in order to form the wiring to desired circuitry, considerable multilayering is needed and cost becomes high. A wire length increases and makes a signal delayed, so that the degree of multilayering becomes large. Therefore, it is not suitable for the circuitry which requires especially improvement in the speed.

[0008]Since the multi chip module shown in drawing 14 uses the thick film ceramic substrate 10 and the thin film circuit board 20, cost becomes high. Since the ceramic part of the thick film ceramic substrate 10 and the surface states (curving granularity, pore, etc.) of the wiring (pad portion) to be exposed from now on influence greatly when forming the thin film circuit board 20, The defect of thin film forming occurs according to the surface state of the thick film ceramic substrate 10, and the yield of a multi chip module is worsened.

[0009]This point is advantageous in order that the multi chip module shown in drawing 15 may use the base board 24 with a cheap and sufficient surface state like metal, such as a pure ceramic substrate, a silicon wafer, or aluminum. However, the package 22 for mounting in a printed-circuit board is required, and it is a high cost. If the characteristic of the package 22 is bad, the signal outputted from a multi chip module will be delayed, or a noise will become large, and the characteristic of a multi chip module will get worse. When it is necessary to increase the number of the I/O pins 28 or and the number of circuit elements which carries in the base board 24 needs to be increased by change of circuitry, etc., the necessity of remaking the package 22 occurs. Therefore, there are problems, like an increase in cost, redesign, and re-manufacture take time.

[0010]The necessity of newly making the thick film ceramic substrate 10 and

the base board real wearing package 22 as drawing 13 and a problem common to 14 and 15 whenever it changes the shape of a multi chip module occurs, TAT (Turn Around Time) and cost of a multi chip module design and manufacture will increase.

[0011]This invention solves the above problem and an object of this invention is to provide the multi chip module which are low cost, high density, and a high speed, and has the flexibility of a design and manufacture.

[0012]

[Means for Solving the Problem]Composition of this invention is explained with reference to drawing 1.

[0013]The multi chip module 100 of this invention is provided with the following.

Base board 30.

The thin film multilayered circuit board 32 by which it was provided on the 1st [of the base board 30] field, and an insulating layer and a wiring conductor were laminated by turns.

The circuit elements 14 and 16 provided on the principal surface of the thin film multilayered circuit board 32.

A terminal which is supported on the principal surface of the thin film multilayered circuit board 32, and connects said wiring conductor to an external circuit formed in the wiring board 18.

[0014]

[Function]Since the wiring conductor is formed in the thin film multilayered circuit board 32, the base board 30 does not need a wiring conductor. Therefore, since it is not necessary to use the thick film ceramic substrate of expensive multilayered constitution as shown in drawing 13 or drawing 14, a multi chip module can be manufactured cheaply.

[0015]Since it is not necessary to use a base board real wearing package as shown in drawing 15, while being able to manufacture a multi chip module cheaply, influence by the characteristic of a base board real wearing package is not received. Therefore, the characteristic of a multi chip module is good.

[0016]Even when a design variation etc. occur, it can respond only by change of the thin film circuit board 32. In addition, even if the shape of a multi chip module changes, it can respond easily by change (for example, cutting of the thin film circuit board 32) of the shape of the thin film circuit board 32, and TAT and cost of a multi chip module design and manufacture can be improved substantially.

[0017]

[Example]The 1st example of this invention is described with reference to drawing 1 and drawing 2.

[0018]Drawing 2 is an expanded sectional view showing the important section of the multi chip module 100 of the PGA (Pin Grid Array) type shown in drawing 1. In drawing 2, the same reference number is given to the same component as drawing 1. On the base board 30, the thin film multilayered circuit board 32 is formed. The thin film multilayered circuit board 32 is

multilayered constitution so that it may illustrate. In details, more the thin film multilayered circuit board 32 Wiring conductor 32A-1, wiring conductor 32A-2, the 3rd wiring conductor 32A-3, the 4th wiring conductor 32-4, and the 5th wiring conductor 32A-5, It has insulating-layer 32B-1, insulating-layer 32B- 2, insulating-layer 32B-3, insulating-layer 32B- 4, and insulating-layer 32B- 5. These wiring conductors and insulating layers are laminated as shown in drawing 2 sequentially from the base board 30.

[0019]Wiring conductor 32A-5 is a pad for attaching the I/O pin 34 and LSI chip 14. Pad 32A-5 which attaches the I/O pin 34 is arranged in array form. Wiring conductor 32A-1 thru/or 32A-4 are prolonged in length and a transverse direction in the thin film multilayered circuit board 32. The wiring conductor in a different layer is connected via the beer hall formed in the insulating layer which intervenes among these wiring conductors. For example, wiring conductor 32A-1 is connected to wiring conductor 32A-2 via the beer hall 36 formed in insulating-layer 32B-1. Wiring conductor 32A-1 is a voltage plane, for example.

[0020]The thin film multilayered circuit board 32 constituted as mentioned above can be formed by the usual LSI manufacturing process.

[0021]The clamp face of pad 32A-5 is exposed from insulating-layer 32B-5. The I/O pin 34 is attached to pad 32A-5 using the solder 38. The field of exposed pad 32A-5 is larger than the mounting part 34a of the I/O pin 34. In the composition of drawing 32, wiring conductor 32A-1 which is a voltage plane is connected to the I/O pin 34 on the left-hand side of drawing 32 via the beer hall. In the 1st example of this invention, it is characterized by the composition which attached to the thin film multilayer interconnection board 32 the I/O pin 34 inserted in the printed circuit board 18. Soldering of the I/O pin 34 can be performed by the existing method.

[0022]LSI chip 14 is attached to pad 32A-5 using the vamp 40 of solder. It may replace with the vamp 40 and wire bonding and a TAB (Tape Automated Bonding) lead may be used.

[0023]Here, the material of each part of the multi chip module shown in drawing 1 and drawing 2 is explained. The base board 30 uses the metal by alloys, such as ceramics, such as AlN, aluminum s2 sO s3 s, and the mullite (Mulite), aluminum, Cu, and Cu-W, Si, glass, etc. The base board 30 may be formed using resin, such as an insulating material of common printed-circuit boards, such as glass epoxy and glass polyimide.

[0024]Insulating-layer 32B-1 of the thin film multilayered circuit board 32 thru/or 32B-5 are formed using organic materials, such as polyimide, Teflon, and epoxy. aluminum, Cu, etc. are used for wiring conductor 32A-1 thru/or 32A-5.

[0025]Things which were not limited to above-mentioned composition, for example, laminated arbitrary numbers of conductor wiring layers via the insulating layer can be used for the thin film multilayered circuit board 32.

[0026]Drawing 3 is the perspective view which looked at the multi chip module 100 from the bottom side. The I/O pin 34 is arranged by the

periphery of the thin film multilayered circuit board 32 so that the passive components 16, such as LSI chip 14 and resistance, and a capacitor, may be surrounded. The I/O pin 34 is simplified for convenience. The fin type heat sink 42 for cooling is formed in the field (rear face) of the opposite hand on the whole surface in the base board 30 in which the thin film multilayered circuit board 30 was formed. What has a pipe (a graphic display is omitted) which lets cooling water pass may be used into the heat sink 42.

[0027]Drawing 4 is a perspective view showing signs that the multi chip module 100 was mounted in the printed-circuit board 18. On the component side 18a of the printed-circuit board 18, the multi chip module and the semiconductor device 46 are carried. It is given as the cooling wind blows 44 show by the arrow of a figure.

[0028]Drawing 5 is a side view of the multi chip module 100A by the 2nd example of this invention. In drawing 5, the same reference number is given to the same thing as the component shown in the figure mentioned above. The multi chip module 100A shown in drawing 5 is a FLT (Flat) package type. The I/O pin 50 consists of a Galle wing type lead, and is soldered to pad 32A-5 shown in drawing 2. The multi chip module 100A shown in drawing 5 has the same effect as the 1st example mentioned above. However, there are few I/O pins 50 which can be attached than the PGA type I/O pin 34. Cooling structure as well as the 1st example can be used.

[0029]The I/O pin 50 may be a TAB lead.

[0030]Drawing 6 is a side view of the multi chip module 100B by the 3rd example of this invention. In drawing 6, the same reference number is given to the same thing as the component shown in the figure mentioned above. The multi chip modules 100B shown in drawing 6 are leadless types, such as BGA (Ball Grid Array) and LGA (Land Grid Array). The vamp 52 of solder is attached to pad 32A-5 shown in drawing 2. In order to simplify a figure, drawing 6 shows every one vamp 52 to right and left, but the vamp 52 can also be arranged to array form like a PGA type. The multi chip module 100B shown in drawing 6 has the same effect as the 1st example mentioned above. In a LGA type, it replaces with the vamp 52 and a flat pad is used. Cooling structure as well as the 1st example can be used.

[0031]Drawing 7 is a side view of the multi chip module 100C by the 4th example of this invention. In drawing 7, the same reference number is given to the same thing as the component shown in the figure mentioned above. The multi chip module 100C shown in drawing 7 is a wire bonding type. Bonding of the wire 54 is carried out to pad 32A-5 shown in drawing 2. Unlike the 1st to 3rd example mentioned above, it is carried after the base board 18 has touched on the printed-circuit board 18. In the 4th example, cooling structure like the 1st to 3rd example cannot be used. In the 4th example, it cools via the printed-circuit board 18.

[0032]As mentioned above, although the example of the I/O terminal was given, this invention is not limited to these. This invention contains the I/O terminal of various types supported by the thin film multilayer

interconnection board 32.

[0033]Drawing 8 is a side view showing the composition which formed the covering 56 which becomes the multi chip module 100 shown in drawing 1 from resin. The covering 56 is formed so that the circuit element 16 of LSI chip 14 or others may be closed. Resin can use the thing of an epoxy system or a silicon system (potting). The covering 56 of resin may be formed so that a part of LSI chip 14 and circuit element 16 may be closed.

[0034]The covering 56 can be used also like the 2nd thru/or the 4th example.

[0035]The side view showing the composition which formed the lid 58 in the multi chip module 100 which shows drawing 1 drawing 9, drawing 10, and drawing 11 are the perspective views showing the composition which attached the heat sink 42 further shown in drawing 3 to the composition shown in drawing 9. The lid 58 is attached on the thin film multilayered circuit board 32 via the sealing member 60. In the composition shown in drawing 9 and drawing 10, the lid 58 closes the circuit element 16 of all the LSI chips 14 and others. As shown in drawing 10, the hollow 58a which reinforces the lid itself is formed in the lid 58. It can also use for heat dissipation via heat-conduction material between this hollow 58a and LSI chip 14. A lid which closes some of LSI chips 14 and circuit elements 16 may be used. The lid 58 can be formed by metal or resin, such as aluminum or covar.

[0036]The cooling structure which can be used by the multi chip module of this invention is not limited to the above-mentioned heat sink 42, but can attach arbitrary cooling structures to the base board 30. For example, it is independent, or the fin type heat sink (air cooling or for water-cooled cooling) 62, the cold plate (for water-cooled cooling) 64, and the plate 66 with a built-in Peltier device which are shown in drawing 12 may be combined arbitrarily [these], and may be used.

[0037]What is necessary is just to mount on the printed-circuit board 18 using the support member used from the former, when the intensity of the base board 30 becomes a problem by adopting cooling structure.

[0038]

[Effect of the Invention]As explained above, in this invention, the base board which writes with the composition which supports an I/O contact button with the exterior on a thin film multilayered circuit board, and supports a thin film multilayer interconnection board does not need a wiring conductor, and does not need a base board real wearing package, either.

Therefore, the multi chip module of the good characteristic can be manufactured cheaply.

[0039]Even when a design variation etc. occur, even if it can respond only by change of a thin film circuit board and also the shape of a multi chip module changes, it can respond easily by change of the shape of a thin film circuit board, and TAT and cost of a multi chip module design and manufacture can be improved substantially.

[Brief Description of the Drawings]

[Drawing 1]It is a side view of the multi chip module by the 1st example of this invention.

[Drawing 2]It is the sectional view which expanded the important section of the multi chip module shown in drawing 1.

[Drawing 3]It is the perspective view which looked at the multi chip module shown in drawing 1 from the pars basilaris ossis occipitalis.

[Drawing 4]It is a perspective view showing signs that the multi chip module shown in drawing 1 thru/or drawing 3 was carried in the printed-circuit board.

[Drawing 5]It is a side view of the multi chip module by the 2nd example of this invention.

[Drawing 6]It is a side view of the multi chip module by the 3rd example of this invention.

[Drawing 7]It is a side view of the multi chip module by the 4th example of this invention.

[Drawing 8]It is a side view of composition of having provided covering which becomes a multi chip module shown in drawing 1 from resin.

[Drawing 9]It is a side view of composition of having provided covering which becomes a multi chip module shown in drawing 1 from a lid.

[Drawing 10]It is the side view which looked at the composition which attached cooling structure to the multi chip module of composition of being shown in drawing 9 from the pars basilaris ossis occipitalis.

[Drawing 11]It is the side view which looked at the composition which attached cooling structure to the multi chip module of composition of being shown in drawing 9 from the upper part.

[Drawing 12]It is a side view showing cooling structure applicable to the multi chip module of this invention.

[Drawing 13]It is a side view showing the example of 1 composition of the conventional multi chip module.

[Drawing 14]It is a side view showing another example of composition of the conventional multi chip module.

[Drawing 15]It is a side view showing another example of composition of the conventional multi chip module.

[Description of Notations]

14 LSI chip

16 Passive component

18 Printed-circuit board

30 Base board

32 Thin film multilayered circuit board

34 I/O pin

36 Beer hall

38 Solder

40 Vamp

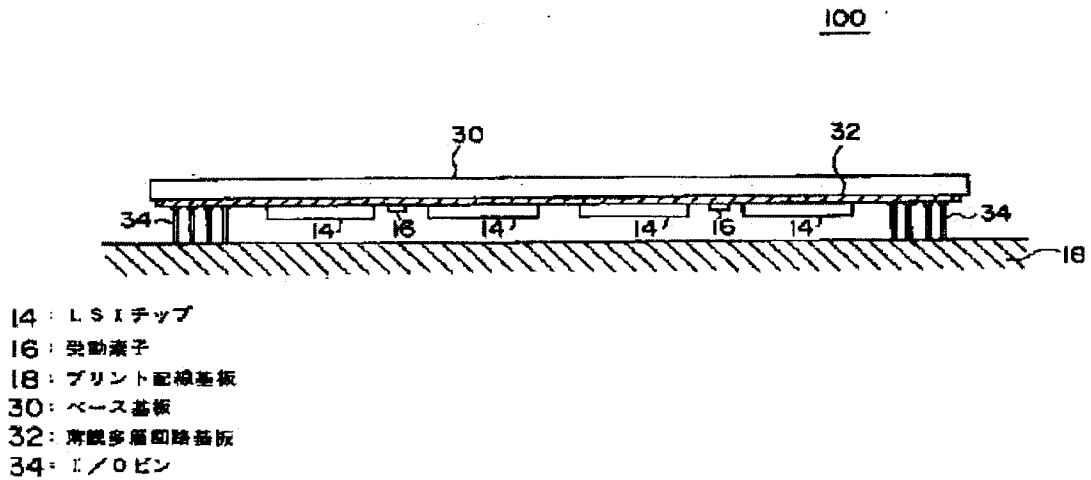
42 Heat sink

44 Cooling wind blows

46 Passive component
50 The I/O pin of the Galle wing die
52 Vamp
54 Bonding wire
56 Resin cover
58 Lid
60 Sealing member
62 Cooling fin
64 Cold plate
66 A plate with a built-in Peltier device

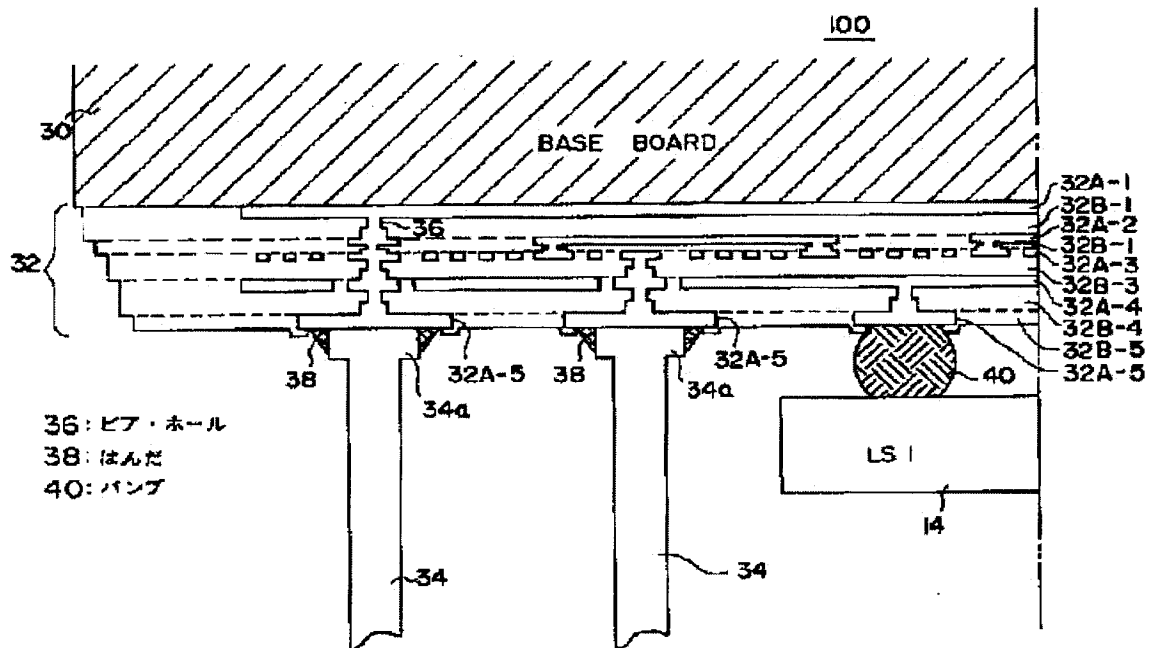
【図1】

本発明の第1の実施例によるマルチチップ・モジュールの側面図である。



【図2】

図1に示すマルチチップ・モジュールの要部を拡大した断面図である。



【図5】

本発明の第2の実施例によるマルチチップ・モジュールの側面図である。



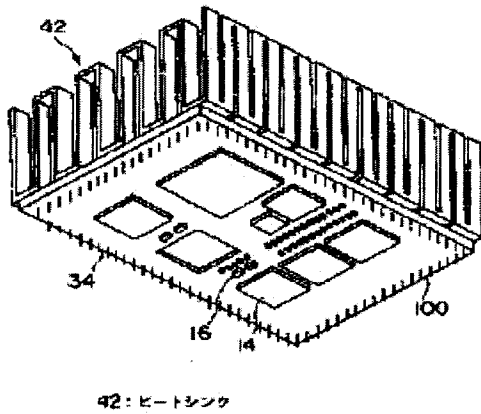
【図8】

図1に示すマルチチップ・モジュールに側面からなるカバーを設けた構成の側面図である。



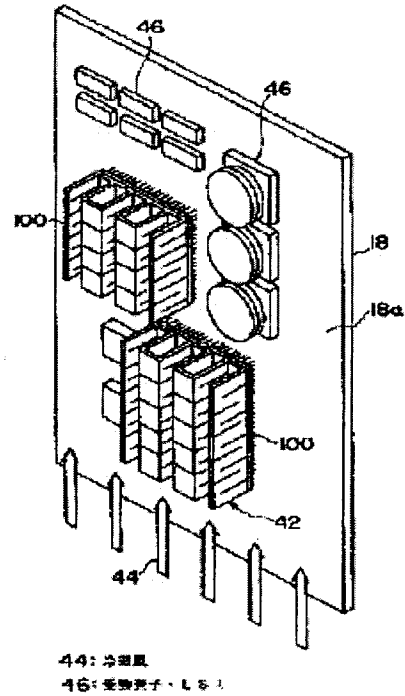
【図3】

図1に示すマルチチップ・モジュールを底部から見た斜視図である。



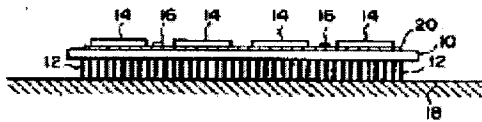
【図4】

図1ないし図3に示すマルチチップ・モジュールをプリント配線基板上に搭載した様子を示す斜視図である。



【図14】

図1のマルチチップ・モジュールの別の構成例を示す側面図である。



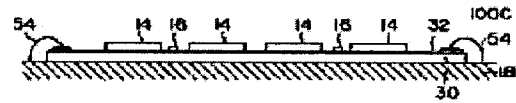
【図6】

本発明の第3の実施例によるマルチチップ・モジュールの側面図である。



【図7】

本発明の第4の実施例によるマルチチップ・モジュールの側面図である。



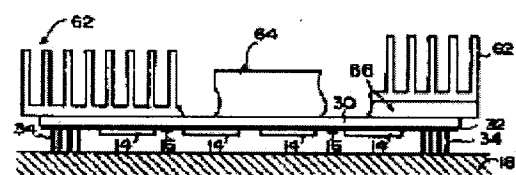
【図9】

図1に示すマルチチップ・モジュールに蓋からなるカバーを設けた構成の側面図である。



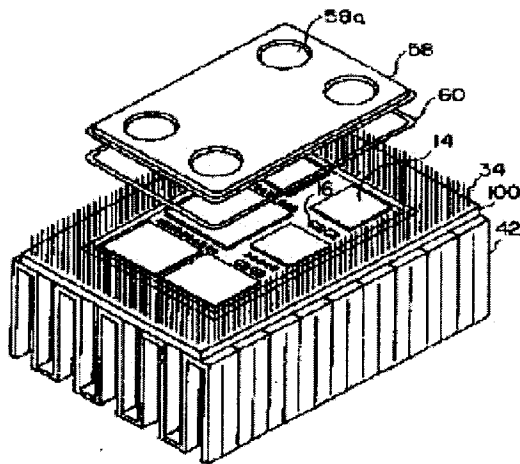
【図12】

本発明のマルチチップ・モジュールに適用可能な冷却構造を示す側面図である。



【図10】

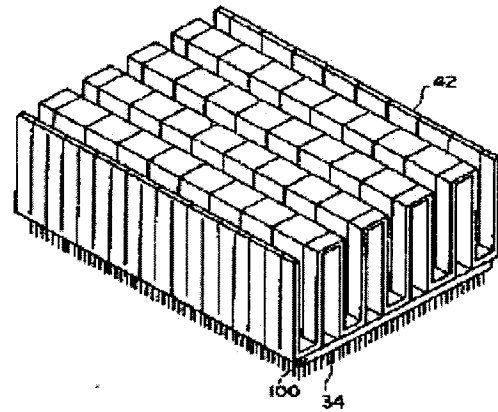
図9に示す構成のマルチチップ・モジュールに冷却構造を取り付けた構成を底面から見た側面図である。



58: 集
60: シール部材

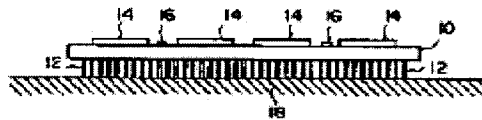
【図11】

図9に示す構成のマルチチップ・モジュールに冷却構造を取り付けた構成を上部から見た側面図である。



【図13】

従来のマルチチップ・モジュールの構成例を示す側面図である。



【図15】

従来のマルチチップ・モジュールの別の構成例を示す側面図である。

